

# PATENT ABSTRACTS OF JAPAN

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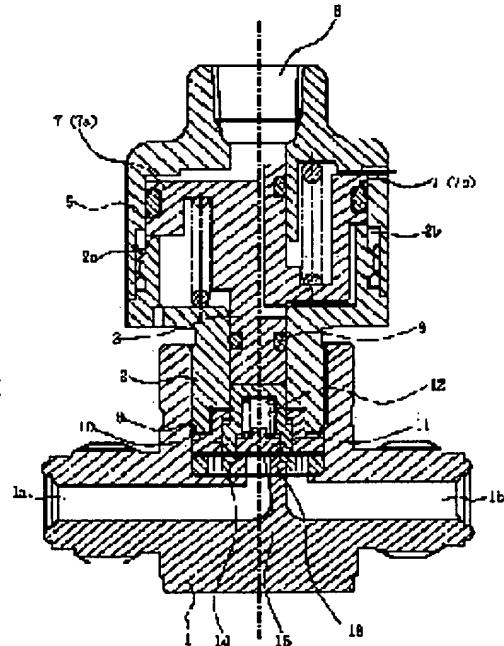
YAMASHIMA ATSUSHI

## (54) DIAPHRAGM VALVE

### (57)Abstract:

**PURPOSE:** To prevent deformation or damage of a valve seat, form a drive part compact, and use the valve seat of a variety of materials.

**CONSTITUTION:** A diaphragm valve is composed of a main body 1 having an inflow passage 1a and an outflow passage 1b, a hollow cylindrical guide member 2 engaged inside the main body 1, a valve shaft 3 provided at a center part of the guide member 2, an actuator cover 5, an air supply port 6, a drive part 7 formed integrally with the valve shaft 3 above it, a diaphragm presser positioned at a bottom part of the guide member 2, a second actuator member 10 positioned at a center of the diaphragm presser 9, and a first actuator member 11 positioned inside the second actuator member 10. The second actuator member 10 and the first actuator member 11 are driven by the drive part 7 and a spring 12 respectively.



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**CLAIMS****[Claim(s)]**

[Claim 1] The body which has the inflow way and outflow way of a fluid, and the valve seat allotted to the perimeter of said inflow way, The diaphram which is arranged on said valve seat and performs closing motion between said inflow ways and said outflow ways, In the diaphragm valve equipped with the mechanical component which drives the actuator carbon button prepared in the upper part of said diaphram, and said actuator carbon button in the vertical direction The diaphragm valve characterized by said actuator carbon button consisting of the 1st actuator member located in the upper part of the inside part of said diaphram, and the 2nd actuator member located in the upper part of the lateral part of said diaphram.

[Claim 2] The diaphragm valve according to claim 1 characterized by consisting of the 1st drive part to which said mechanical component drives said 1st actuator member, and the 2nd drive part which drives said 2nd actuator member.

[Claim 3] The diaphragm valve according to claim 2 characterized by for said 1st drive part driving with a spring, and said 2nd drive part driving with gas pressure.

[Claim 4] The diaphragm valve according to claim 2 characterized by said 1st drive part and said 2nd drive part driving with gas pressure.

[Claim 5] The diaphragm valve according to claim 4 characterized by driving with gas pressure with separate said 1st drive part and said 2nd drive part.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] This invention relates to the metal diaphragm valve which can be used suitable for Rhine especially high grade Rhine, a special gas line, or a sampling line general gas centering on the manufacture fields, such as a semi-conductor and liquid crystal, and for liquid etc. about a diaphragm valve.

#### [0002]

[Description of the Prior Art] The diaphragm valve used as an example of the conventional structure of the above diaphragm valves in the gas piping system of the super-high grade gas of for example, a semi-conductor production line was shown in drawing 4 R> 4. In more detail, this example is a direct seal mold diaphragm valve, and consists of the valve stem 103 located in the center section of the guide member 102 by which fitting was carried out inside [ which has inflow way 101a and outflow way 101b ] the body 101 and the body 101, and the guide member 102, actuator covering 105, an Ayr feed hopper 106, a mechanical component 107 formed in the upper part of a valve stem 103 at the list.

[0003] Between a valve stem 103 and the guide members 102 is established in the airtight ring 108 for seal by the periphery of a valve stem 103. The diaphragm presser foot 109 is located in the pars basilaris ossis occipitalis of the guide member 102. The junction ball 110 is contained in the through-hole of the center of the diaphragm presser foot 109. The actuator carbon button 111 is located under the junction ball 110. A sheet (valve seat) 112 is attached in the upper part of inflow way 101a of a body 101, and outflow way 101b with the sheet electrode holder 113. Diaphragm (metal diaphragm) 114 is arranged between the upper part of a sheet 112, and the diaphragm presser foot 109.

[0004] As it functions as a valve element which opens and closes between inflow way 101a and outflow way 101b and was shown in drawing 5 in detail, diaphragm 114 is pinched between the periphery section inferior surface of tongue of the diaphragm presser foot 109, and the sheet electrode holder 113, and the center section of diaphragm 114 contacts or estranges it on a sheet 112. Closing motion of diaphragm 114 is performed by supply of the compressed air to the Ayr feed hopper 106.

[0005] And with structure, it is considering as the configuration which applies the force to which diaphragm 114 is made to deform into and the seal of the sheet 112 is carried out through the actuator carbon button 111 from a mechanical component 107 conventionally [ this ].

#### [0006]

[Problem(s) to be Solved by the Invention] Conventionally, with structure, as mentioned above, apply the force through the actuator carbon button of a simple substance from one mechanical component, diaphragm is made to deform, and it is considering as the configuration which carries out the seal of the valve seat. However, the internal pressure which joins the lower part of diaphragm by the hydrostatic pressure which passes along an inflow way and an outflow way in this case, and the force of making diaphragm deforming into a list are large, and, for this reason, there is a problem that the force for carrying out the seal of the valve seat with diaphragm becomes small relatively.

[0007] Especially in the case of the valve for high pressures, the force of always opposing the highest working pressure serves as max. That is, it becomes the relation of force \*\* for [ which is carried out a force > seal ] making the force > diaphragm which opposes the highest working pressure deform. In addition, in the case of metal diaphragm, the force of opposing the highest working pressure points out the thing of the effective-area x highest working pressure of diaphragm.

[0008] And conventionally, in the case of structure, it is designed so that the force which overcomes the comprehensive force of the force for carrying out a seal to the force in which the above opposes, the force made to deform, and a list may be applied to diaphragm as one through a single actuator carbon button from a mechanical component. For this

reason, when diaphragm pastes a valve seat, or when the above-mentioned internal pressure is lower than the highest working pressure, the excessive force will be added to a valve seat. And for this reason, it deforms beyond the need, or excessive stress occurs in a valve seat, the deformation of diaphragm increases according to deformation of a valve seat, and the problem of the life of diaphragm being shortened arises.

[0009] Moreover, there is also a problem that an usable valve seat (sheet quality of the material) is restricted to what has the comparatively hard quality of the material from the excessive force beyond the need joining a valve seat as mentioned above.

[0010] This invention aims at offering the diaphragm valve which can be made in order to solve the technical problem of the above-mentioned conventional technique, can prevent the deformation and damage on the valve seat by the excessive force being added, and diaphragm, and can attain the miniaturization of a mechanical component, and can use the valve seat of the various quality of the materials.

[0011]

[Means for Solving the Problem] The body which this invention is made so that it may attain the above-mentioned purpose, and has the inflow way and outflow way of a fluid, The valve seat allotted to the perimeter of an inflow way, and the diaphragm which is arranged on a valve seat and performs closing motion between an inflow way and an outflow way, In the diaphragm valve equipped with the mechanical component which drives the actuator carbon button prepared in the upper part of diaphragm, and an actuator carbon button in the vertical direction An actuator carbon button is considered as the configuration which consists of the 1st actuator member located in the upper part of the inside part of diaphragm, and the 2nd actuator member located in the upper part of the lateral part of diaphragm.

[0012]

[Function] In the diaphragm valve of this invention, it separates into the 1st actuator member which opposes the seal force of a valve seat in an actuator carbon button, and the 2nd actuator member which opposes the force in which internal pressure pushes up metal diaphragm, and considers as the configuration which drives these separately. And for this reason, only the force which is required to carry out the seal of the valve seat by the 1st actuator member can be applied to a valve seat.

[0013]

[Example]

(Example 1) The structure of the diaphragm valve of the example of this invention was shown in drawing 1 . This diaphragm valve consists of mechanical-component 7 grades formed [ the valve stem 3 prepared in the center section of the hollow tubed guide member 2 by which fitting was carried out inside / which has inflow way 1a of a fluid, and outflow way 1b / the body 1 and the body 1, and the guide member 2, the actuator covering 5, the Ayr feed hopper 6, and the list ] in the upper part of a valve stem 3 at this and one. In addition, the mechanical component 7 showed mechanical-component 7b of the right-hand side as structure of NO (normally open) mold for left-hand side mechanical-component 7a as structure of NC (normally closing) mold in drawing, respectively.

[0014] The airtight ring 8 for sealing between a valve stem 3 and the guide members 2 is formed in the periphery of a valve stem 3. The diaphragm presser foot 9 is located in the pars basilaris ossis occipitalis of the guide member 2. The 2nd actuator member 10 is located in the through-hole formed in the center of the diaphragm presser foot 9. The 1st actuator member 11 is located inside the 2nd actuator member 10. Here, the spring 12 is formed between the top face of the 1st actuator member 11, and the inner base of the 2nd actuator member 10. Moreover, the top face of the 2nd actuator member 10 is contacted by the inferior surface of tongue of a valve stem 3.

[0015] The cylinder-like sheet (valve seat) 13 is attached in the upper part of inflow way 1a of the center section of the body 1, and outflow way 1b with the sheet electrode holder 14. Moreover, diaphragm 15 is arranged between the upper part of a sheet 13, and the diaphragm presser foot 9. In addition, in the above configuration, a body 1 and the sheet electrode holder 14 are stainless steel, and sheets 13 are 3 ethylene resin fluoride, and polyimide or the synthetic resin of polytetrafluoroethylene resin, and diaphragm 15 is a nickel alloy etc. and is constituted, respectively.

[0016] Diaphragm 15 functions as a valve element which opens and closes the path between inflow way 1a and outflow way 1b. That is, diaphragm 15 is pinched between the periphery section inferior surface of tongue of the diaphragm presser foot 9, and a sheet 13, it is that the central part estranges or contacts a sheet 13, and the path between inflow way 1a and outflow way 1b opens and closes.

[0017] In this example, the seal of the sheet 13 by diaphragm 15 is performed as follows. That is, when a mechanical component 7 is mechanical-component 7a of left-hand side NO mold, a compressed air is first supplied to the Ayr feed hopper 6. Then, a mechanical component 7 is depressed caudad and the 2nd actuator member 10 located outside by the valve stem 3 is depressed in that case.

[0018] Here, stopper 2a of the letter of a projection is formed in the guide member 2 of the location of the inside part of

the actuator covering 5. And the downward location of a mechanical component 7 is restricted by this stopper 2a. That is, downward movement of a mechanical component 7 and the 2nd actuator member 10 stops by stopper 2a, just before a sheet 13 carries out a seal. For this reason, the driving force by the mechanical component 7 does not join a sheet 13 as it is. And in this idle state, the periphery section of diaphragm 15 is pinched between the inferior surface of tongue of the 2nd actuator member 10, and the top face of the sheet electrode holder 14, and it will be in the condition of having opposed the force in which the diaphragm 15 by internal pressure was pushed up by this.

[0019] Subsequently, in this idle state, the 1st actuator member 11 located inside is forced on a sheet 13 by the elastic force of a spring 12, and the seal of the sheet 13 is carried out. Thereby, diaphragm 15 and a sheet 13 stick and diaphragm 14 will be in a close condition.

[0020] Moreover, when supply of the above-mentioned compressed air is canceled, as a result of a mechanical component's 7 being pushed up by the elasticity of an inside spring, a clearance is made between diaphragm 15 and a sheet 13, and diaphragm 15 will be in an open condition.

[0021] On the other hand, when a mechanical component 7 is mechanical-component 7b of right-hand side NC mold, in the condition that the compressed air is not supplied, a mechanical component 7 is caudad depressed by the elasticity of internal coiled spring. In this case, the downward location of a mechanical component 7 is restricted by stopper 2b of the same letter of a projection as the above prepared in the inside part of the actuator covering 5, and downward movement of a mechanical component 7 and the 2nd actuator member 10 stops, just before a sheet 13 carries out a seal. Moreover, in this idle state, like the above, the 1st actuator member 11 is forced on a sheet 13 by the elastic force of a spring 12, the seal of the sheet 13 is carried out, and diaphragm 14 will be in a close condition.

[0022] Moreover, when a compressed air is supplied from the Ayr feed hopper 6, as a result of pushing up a mechanical component 7, a clearance is made between diaphragm 15 and a sheet 13, and diaphragm 15 will be in an open condition.

[0023] (Example 2) The structure of the diaphragm valve of other examples of this invention was shown in drawing 2. This diaphragm valve Inflow way 21a of a fluid, and outflow way 21b The valve stem 23 located inside the hollow tubed guide member 22 by which fitting was carried out inside the body 21 which it has, and the body 21, the 2nd actuator member 30 prepared inside the guide member 22, and the 2nd actuator member 30, the actuator covering 25 located in the upper part of a diaphragm valve, It consists of mechanical-component 27 grades formed [ the Ayr feed hopper 26 formed in the center of the upper part of the actuator covering 25, and the list ] in the upper part of a valve stem 23 at this and one.

[0024] The airtight ring which consists of an O ring etc. is suitably prepared in the periphery of a valve stem 23. The diaphragm presser foot 29 is located in the pars basilaris ossis occipitalis of the guide member 22. Inside the diaphragm presser foot 29, the lower limit section of the 2nd above-mentioned actuator member 30 is located. Moreover, inside this lower limit section, 1st cross-section [ of T characters ]-like press member 31a, the 2nd ball-like press member, press member of \*\* tabular 3rd 31c, and the 1st actuator member 31 are located in a lengthwise direction one by one.

[0025] The cylinder-like sheet 33 is attached in the upper part of inflow way 21a of the center section of the body 21, and outflow way 21b with the sheet electrode holder 34. Moreover, diaphragm 35 is arranged between the sheet 33 and the diaphragm presser foot 29. In addition, in the above configuration, a body 21, a sheet 33, the sheet electrode holder 34, and diaphragm 35 grade consist of the same quality of the materials as the above-mentioned example.

[0026] Diaphragm 35 functions as a valve element which opens and closes the path between inflow way 21a and outflow way 21b, and is pinched between the diaphragm presser foot 29 and a sheet 33, it is that the central part estranges or contacts a sheet 33, and the path between inflow way 21a and outflow way 21b opens and closes it.

[0027] Furthermore, mechanical-component 30a driven by the compressed air supplied from the Ayr feed hopper 26 is prepared in the upper part of the 2nd actuator member 30. This mechanical-component 30a is pressed downward by spring 30b in drawing by the normal state to which the above-mentioned compressed air is not supplied. Moreover, the mechanical component 27 of the upper part of the valve stem 23 which presses the 1st actuator member 31 is also pressed downward by spring 27a in drawing by the normal state to which it drives by the compressed air supplied from the Ayr feed hopper 26, and a compressed air is not supplied.

[0028] Here, the thrust of spring 30b is set up more greatly than the thrust of spring 27a. Therefore, although a mechanical component 27 resists the thrust of spring 27a and upper-moves in drawing in the condition that the pressure of the compressed air supplied from the Ayr feed hopper 26 is comparatively small, mechanical-component 30a is in a bottom location in drawing by the thrust of spring 30b. Moreover, in the condition that the pressure of the compressed air supplied from the Ayr feed hopper 26 is large, mechanical-component 30a resists the thrust of spring 30b, and comes to upper-move in drawing.

[0029] In this example, seal actuation of the sheet 33 by diaphragm 35 is the same as that of the above-mentioned

example fundamentally, and is performed as follows.

[0030] First, in the condition that the compressed air is not supplied, mechanical components 30a and 27 are caudad depressed by the elasticity of springs 30b and 27a, respectively. In this case, the downward location of mechanical-component 30b is restricted by stop with the inside part of the guide member 22, and downward movement of mechanical-component 30b and the 2nd actuator member 30 stops, just before a sheet 33 carries out a seal. Moreover, in this idle state, the 1st actuator member 31 is forced on a sheet 33 by the elastic force of spring 27a of a mechanical component 27, the seal of the sheet 33 is carried out, and diaphragm 34 will be in a close condition.

[0031] Moreover, in the condition that squeezing pneumatic pressure is low, when a compressed air is supplied from the Ayr feed hopper 6, as a result of pushing up a mechanical component 27, a clearance is made between diaphragm 15 and a sheet 13, and diaphragm 15 will be in an open condition. And supply a low compressed air from the Ayr feed hopper 6 in this way, namely, the 1st actuator member 31 for sheet seals is made to drive with comparatively small driving force, and the seal of a sheet 33 can be operated.

[0032] (Example 3) The structure of the diaphragm valve of another example was shown in drawing 3. Since this diaphragm valve is the same structure except differing from the example shown in drawing 2 the following point, into the same part, the part of the same structure omits explanation, using the same sign.

[0033] That is, in the diaphragm valve of drawing 3, the 1st actuator member 31 and the 2nd actuator member 30 are driven with another gas pressure. And for this reason, the Ayr feed hopper 26 for supplying squeezing pneumatic pressure to the mechanical component 27 for the drive of the 1st actuator member 31 and the list are equipped with the Ayr feed hopper 27 for supplying squeezing pneumatic pressure at mechanical-component 30a for the drive of the 2nd actuator member 30. Other configurations are the same as that of the example of drawing 2.

[0034] Although the Ayr feed hopper 26 was formed in the center of the upper part of the actuator covering 25 and the Ayr feed hopper 27 was formed in the guide member 22 in the illustrated example here, respectively, it cannot be overemphasized that it can form in a proper part without being limited to these.

[0035] Since seal actuation of the sheet 33 by the diaphragm 35 in this example is the same as that of the example of drawing 2, explanation is omitted.

[0036]

[Effect of the Invention] Since it considered as the configuration which divides an actuator carbon button into the 1st actuator member located in the upper part of the inside part of diaphragm, and the 2nd actuator member located in the upper part of the lateral part of diaphragm, and drives these separately according to this invention the above passage, the following effectiveness is expectable.

[0037] (1) Since only the force which is required to carry out the seal of the valve seat to a valve seat can be applied and it is not necessary to apply the excessive force, improvement in the life of a valve seat can be aimed at, and excessive deformation of a valve seat can be prevented. In the case of a valve seat ingredient which is softened with the case where the valve for high pressures (for example, 150kg/cm<sup>2</sup>) is especially used below with a maximum allowable working pressure, a fluid, heat, etc., it is effective, and improvement in a life and deformation prevention can be aimed at. Moreover, it can be used effective in the all metal seal which the damage to the valve seat by the force to an excessive valve seat is remarkable, and particle tended to generate.

[0038] (2) Since what is necessary is to apply only the force required for the seal of a valve seat, driving force is small, and ends and a mechanical component can be miniaturized.

[0039] (3) Since that the excessive force joins a valve seat can prevent, the comparatively soft ingredient which was not able to be used can be conventionally used for a valve seat. For example, polytetrafluoroethylene resin can be used instead of 3 conventional polyimide and ethylene resin fluoride. And for this reason, also in the case of various kinds of particular gas which was not able to be used, with the conventional ingredient, it can be used effectively. Moreover, conventionally, in the case of the diaphragm valve of this invention, it can be used for the extra-high voltage to which use exceeds difficult 200kg/cm<sup>2</sup> with the configuration which used the valve seat made of resin.

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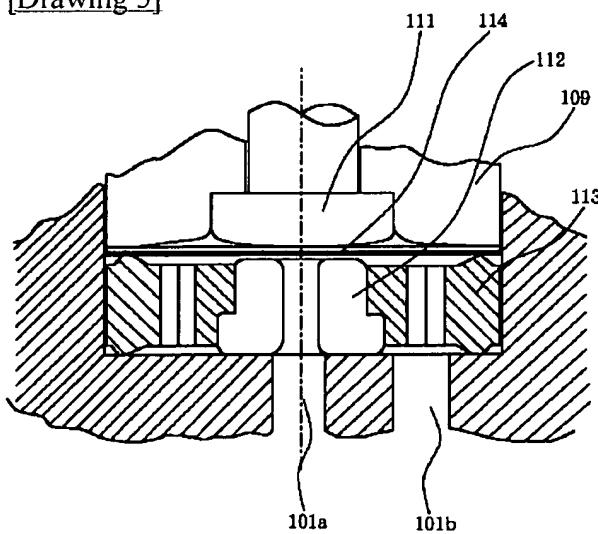
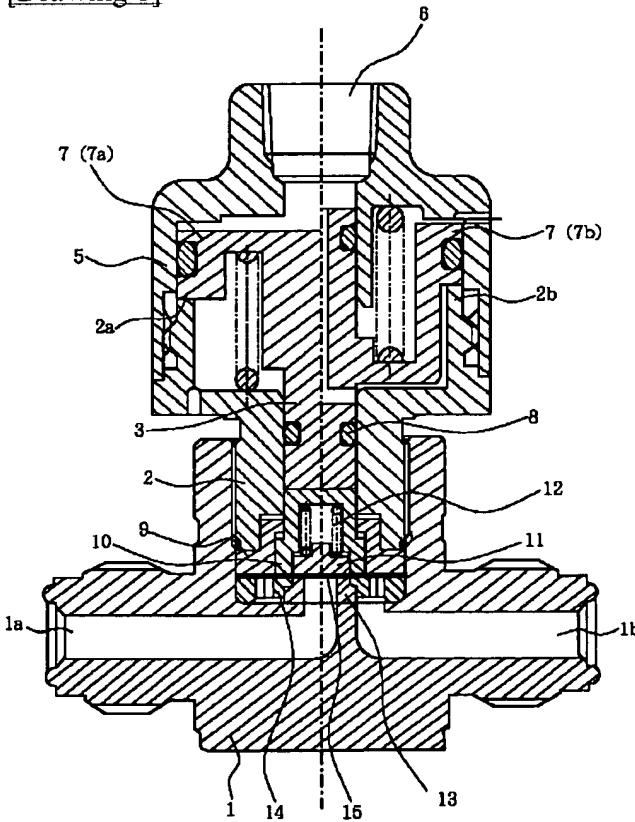
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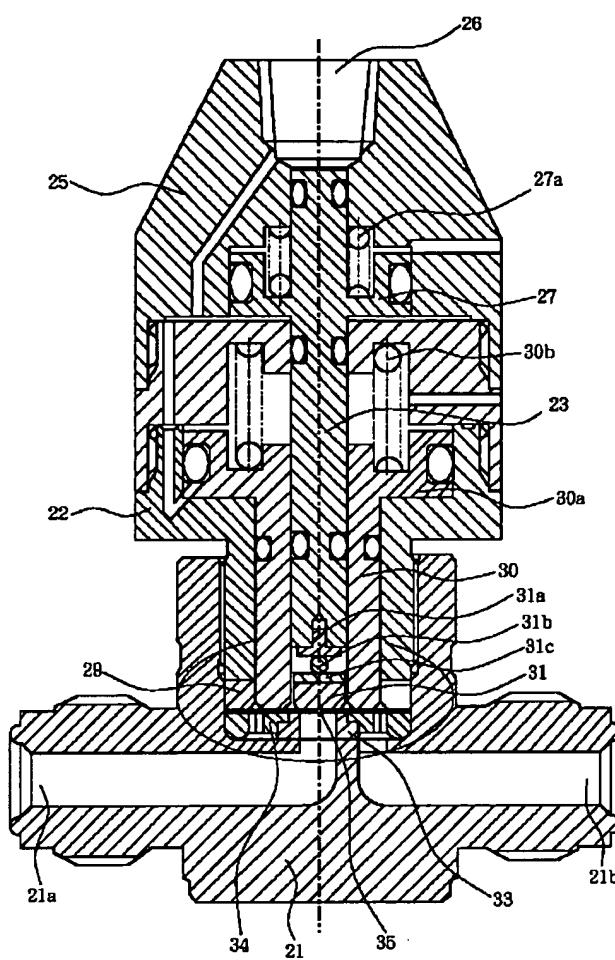
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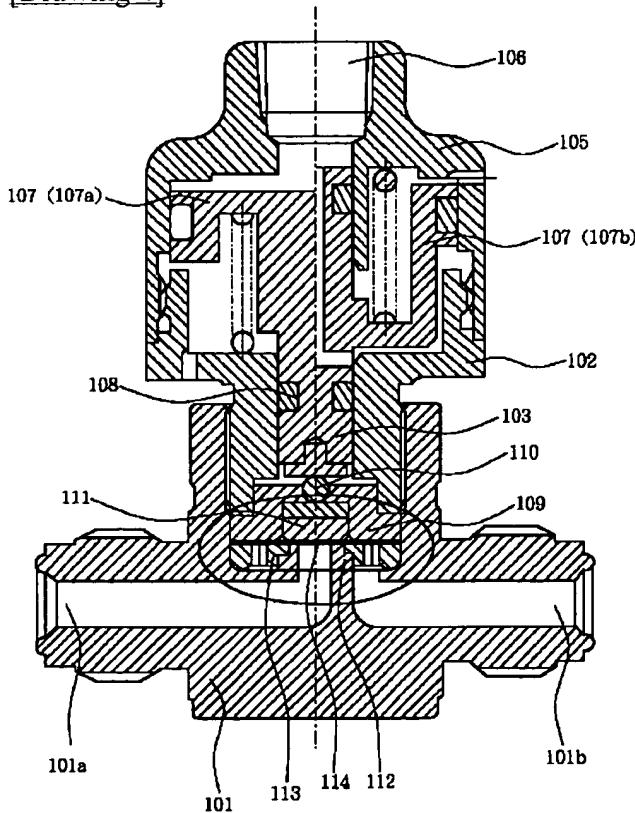
**DRAWINGS**

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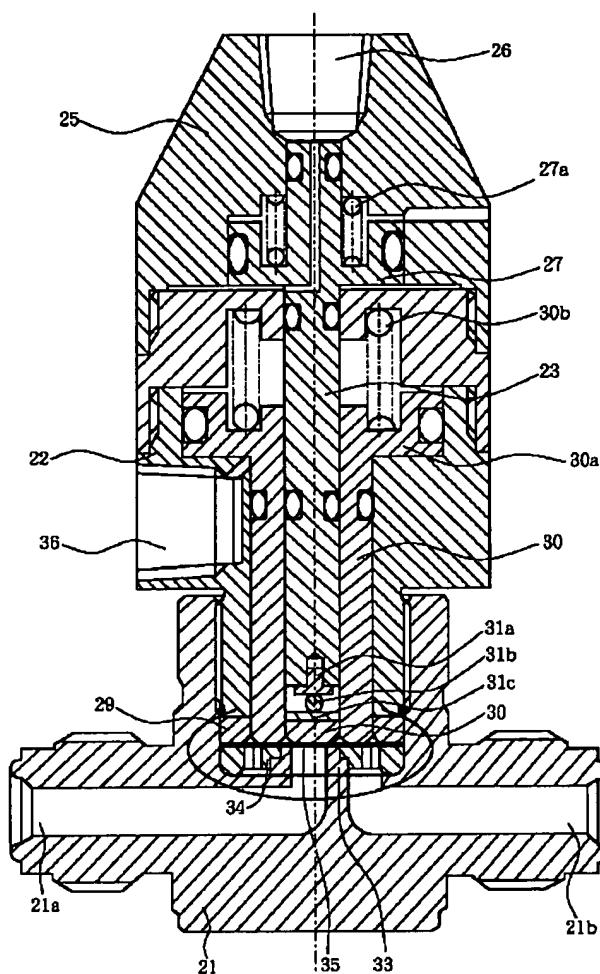
**[Drawing 5]****[Drawing 1]****[Drawing 2]**



[Drawing 4]



[Drawing 3]



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